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Spin-orbit coupled bosons in optical lattices[1]

WILLIAM COLE, The Ohio State University

The interplay between strong correlations and spin-orbit coupling has recently become a significant theme in condensed matter physics. In light of this, we review the proposed realization of a spin-orbit coupled Hubbard model using cold atoms in a synthetic gauge field and an optical lattice potential. Focusing our attention on two component bosons, a variety of theoretical techniques are used to identify broken symmetry states, such as magnetically textured superfluids and Mott insulators. We discuss the spin Hall effect and anomalous Hall effect (in the presence of spontaneous time reversal symmetry breaking). Spin-orbit coupling also leads to interesting plaquette current patterns, and we describe the possibility for experimental confirmation of these using a quench of the lattice potential. Reference: Phys. Rev. Lett. 109, 085302 (2012)

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